

# Portable Intravenous Fluid Production Device For Ground Use Project

Center Independent Research & Developments: KSC IRAD Program  
Office Of The Chief Scientist ( OCS )

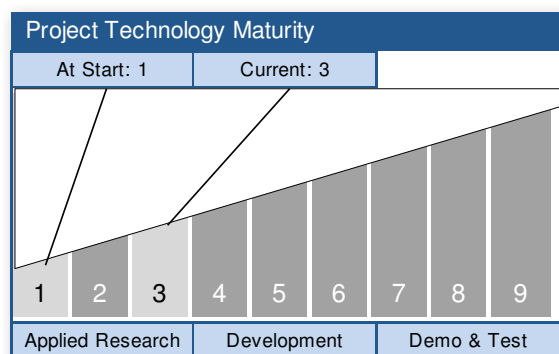
National Aeronautics and  
Space Administration



## ABSTRACT

Several medical conditions require the administration of intravenous (IV) fluids, but limitations of mass, volume, shelf-life, transportation, and local resources can restrict the availability of these important fluids. Such limitations are expected in long-duration space exploration missions and in remote or austere places on Earth. Furthermore, current IV fluid production requires large factory-based processes. Easy, portable, onsite production of IV fluids can eliminate these limitations. Based on experience gained in developing a device for space flight, a ground use device was ...***Read more on the last page.***

Portable Intravenous Fluid Production Device for Ground Use



Technology Area: Human Health, Life Support & Habitation Systems  
TA06 (Primary)

## ANTICIPATED BENEFITS

### To NASA funded missions:

International Space Station.

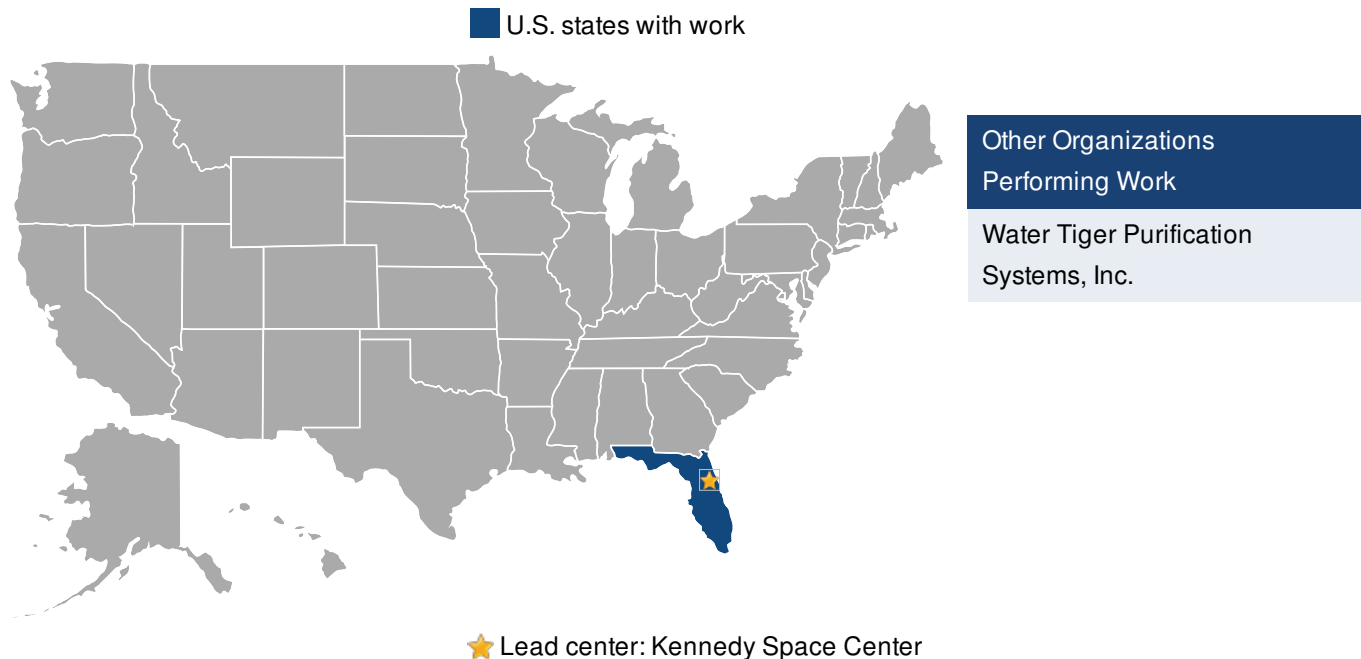
With further development, this unit could suffice as the technology for sterile water and IVF production in spacecraft and lunar and planetary habitation missions.

### To NASA unfunded & planned missions:

Long Duration Asteriod, Lunar, Mars and other planetary Habitation ...

Read more on the last page.





## DETAILED DESCRIPTION

There are several medical conditions that require intravenous fluids. Limitations of mass, volume, storage space, shelf-life, transportation, and local resources can restrict the availability of such important fluids. These limitations are expected in long duration space exploration missions and in remote or austere environments on Earth. Current IV Fluid Production requires large factory-based processes. Easy, portable, on site production of IV fluids can eliminate these limitations. Based on experience gained in developing a device for spaceflight, a ground-use device was developed.

This design uses regular drinking water that is pumped through two filters to produce, in minutes, sterile, ultrapure water that meets the stringent quality standards of the United States Pharmacopeia for Water for Injection (Total Bacteria, Conductivity, Endotoxins, Total Organic Carbon). The device is 2.2 lbs (1kg) and 10L x 5W x 3H inches (25L x 13W x 7.5H cm) in its storage configuration. This handheld device produces one liter of medical-grade water in 21 minutes. Total production capacity for this innovation is expected to be in the hundreds of liters.

The device contains one battery powered electric mini-pump. Alternatively, a manually powered pump can be ...

### MANAGEMENT

**Program Manager:**  
Alexis Hongamen

**Principal Investigator:**  
Philip Scarpa

**Co-Investigator:**  
Wolfgang Scheuer

### DETAILED DESCRIPTION (CONT'D)

attached and used. Drinking water enters the device from a source water bag, flows through two filters, and final sterile production water exits into a sealed, medical-grade collection bag. The collection bag contains pre-placed crystalline salts to mix with product water to form isotonic intravenous medical solutions. Alternatively, a hypertonic salt solution can be injected into a filled bag. The filled collection bag is detached from the device and is ready for use or storage. This device currently contains one collection bag but a manifold of several pre-attached bags or replacement of single collection bags under sterile needle technique is possible for the production of multiple liters. The entire system will be flushed, sealed, and radiation-sterilized.

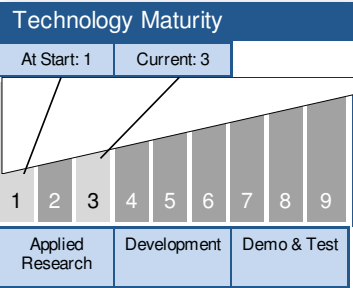
Operation of the device is easy and requires minimal training. Drinking water is placed into the collection bag. Inline stopcock flow valves at the source and collection bags are opened and the mini-pump is turned on by a switch to begin fluid flow. When the collection bag is completely filled with the medical-grade water, the pump can be turned off. The pump is designed so it cannot pump air and overfilling of the collection bag with fluid is avoided by placing an equal amount of water in the source bag. Backflow is avoided by inline check valves. The filled collection bag is disconnected from its tubing and is ready for use. The source bag can be refilled for production of multiple liters or the source bag can be replaced with an input tube which can be placed in a larger potable water source if the device is attended. The device functions in all orientations independent of any gravity fields.

In addition to creating intravenous fluids, the device produces medical grade water which can be used for mixing with medications for injection, reconstituting freeze-dried blood products for injection, or for wound hydration or irrigation.

Potential world-wide use is expected with medical activities in environments that have limited resources, storage, or resupply such as in military field operations, humanitarian relief efforts, submarines, commercial cruise ships, etc.

TECHNOLOGY DETAILS

Portable Intravenous Fluid  
Production Device for  
Ground Use



TECHNOLOGY DESCRIPTION

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This technology is categorized as a hardware system for other applications

- Technology Area
  - TA06 Human Health, Life Support & Habitation Systems (Primary)

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## TECHNOLOGY DETAILS

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### **CAPABILITIES PROVIDED (CONT'D)**

liters.

The device can create ultrapure water for Intravenous fluids. In addition to creating intravenous fluids, the device produces medical grade water which can be used for mixing with medications for injection, reconstituting freeze-dried blood products for injection, or for wound hydration or irrigation.

### **POTENTIAL APPLICATIONS**

The device will be further developed to increase its durability and is expected to be used anywhere that storage, resupply, or resources are limited, such as military field operations, humanitarian relief efforts, submarines, and commercial cruise ships.





## IMAGE GALLERY

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Portable Intravenous Fluid Production Device for Ground Use

## ABSTRACT (CONTINUED FROM PAGE 1)

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developed.



## ANTICIPATED BENEFITS

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### **To NASA unfunded & planned missions: (CONT'D)**

missions.

### **To other government agencies:**

Department of Defense, Department of State.

### **To the commercial space industry:**

Any commercial mission that carries humans.

### **To the nation:**

Potential world-wide use is expected with medical activities in environments that have limited resources, storage, or resupply such as in military field operations, humanitarian relief efforts, submarines, commercial cruise ships, etc.